This listing of claims will replace all prior versions, and listings, of claims in the application:

The Status of the Claims

1. (Original): An external cavity optical transmitter comprising:

a gain chip to emit optical energy;

a grating to receive optical energy emitted by the gain chip and to reflect at least a portion of the optical energy emitted by the gain chip;

a reflector to receive optical energy reflected from the grating, the reflector and the reflective portion of the gain chip forming an optical resonant structure;

an optical modulator to modulate optical energy from the gain chip, the optical modulator having an optimal operating temperature range; and

a temperature controller to maintain the gain chip and the optical modulator at a temperature within the optimal operating temperature range of the optical modulator.

2. (Original): The external cavity optical transmitter as defined in claim 1, wherein the temperature controller maintains the temperature of the gain chip and the optical modulator within the optimal operating temperature range of the optical modulator at which an operating current of the gain chip is minimized.

3. (Original): The external cavity optical transmitter as defined in claim 2, wherein the temperature controller varies the temperature of the optical modulator and the gain chip to determine a temperature at which the operating current of the gain chip is minimized.

4. (Original): The external cavity optical transmitter as defined in claim 3, further including an etalon adjacent the reflector.

5. (Original): An external cavity optical transmitter comprising:

a temperature controlled substrate;

a gain chip having a reflective portion, wherein the gain chip is disposed on the temperature controlled substrate and is adapted to emit optical energy;

a grating disposed on the temperature controlled substrate to receive optical energy emitted by the gain chip and to reflect at least a portion of the optical energy emitted by the gain chip;

a reflector disposed on the temperature controlled substrate to receive optical energy reflected from the grating, the reflector and the reflective portion of the gain chip forming an optical resonant structure;

an optical modulator to modulate optical energy from the gain chip, wherein the optical modulator has an optimal operating temperature range; and

a temperature controller coupled to the temperature controlled substrate to maintain the temperature controlled substrate and the gain chip at a temperature within the optimal operating temperature range of the optical modulator.

6. (Original): The external cavity optical transmitter as defined in claim 5, wherein the temperature controller maintains the temperature controlled substrate at a temperature within the optimal operating temperature range of the optical modulator at which an operating current of the gain chip is minimized.

7. (Original): The external cavity optical transmitter as defined in claim 6, wherein the temperature controller varies the temperature of the temperature controlled substrate within the optimal operating temperature range of the optical modulator to determine a temperature of the temperature controlled substrate at which the operating current of the gain chip is minimized.

8. (Withdrawn): The external cavity optical transmitter as defined in claim 5, further comprising:

a variable optical phase retardation device disposed between the gain chip and the reflector, wherein the variable optical phase retardation device retards a phase of optical energy passing between the gain chip and the reflector by varying a refractive index of the variable optical phase retardation device; and

a voltage source coupled to the variable optical phase retardation device and controlled to maintain the refractive index of the variable optical phase retardation device at a level at which the operating current of the gain chip is minimized.

9. (Withdrawn): The external cavity optical transmitter as defined in claim 8, wherein the voltage source is controlled to vary the refractive index of the variable optical phase retardation device to determine a phase retardation at which the operating current of the gain chip is minimized.

10. (Original): The external cavity optical transmitter as defined in claim 5, wherein the temperature controller varies the temperature of the temperature controlled substrate over a range of temperatures to determine a temperature at which the operating current of the gain chip is minimized.

11. (Original): A method of operating an external cavity optical transmitter including a gain chip and an optical modulator coupled to a temperature controlled substrate having an associated temperature, the method comprising:

maintaining the temperature controlled substrate, the gain chip and the optical modulator between a first temperature and a second temperature between which the optical modulator has an acceptable performance characteristic;

varying the temperature of the temperature controlled substrate, the gain chip and the optical modulator from the first temperature to the second temperature;

measuring an operating current supplied to the gain chip as the temperature of the temperature controlled substrate, the gain chip and the optical modulator varies from the first temperature to the second temperature;

determining an optimum temperature between the first temperature and the second temperature that corresponds to a minimum operating current; and

maintaining the temperature of the temperature controlled substrate, the gain chip and the optical modulator at the optimum temperature.

12. (Original): The method as defined in claim 11, wherein a temperature difference between the first temperature and the second temperature comprises about two degrees Centrigrade.

13. (Original): The method as defined in claim 11, wherein determining an optimum temperature comprises determining operating current as a function of temperature.

14. (Original): The method as defined in claim 13, wherein determining an optimum temperature comprises taking a derivative of the operating current as a function of temperature.

15. (Original): The method as defined in claim 13, wherein determining an optimum temperature comprises taking first and second derivatives of the operating current as a function of temperature.

16. (Original): The method as defined in claim 11, further comprising:

measuring the operating current and comparing it to the minimum operating current; and

if a difference between the operating current and the minimum operating current exceeds a predetermined threshold, (a) varying the temperature of the temperature controlled substrate, the gain chip and the optical modulator from the first temperature to the second temperature, (b) measuring the operating current supplied to the gain chip as the temperature of the temperature controlled substrate, the gain chip and the optical modulator varies from the first temperature to the second temperature, (c) determining a second optimum temperature between the first temperature and the second temperature that corresponds to a second minimum operating current, and (d) maintaining the temperature of the temperature controlled substrate, the gain chip and the optical modulator at the second optimum temperature.

17. (Withdrawn): A method of operating an external cavity optical transmitter including a gain chip, an optical modulator and an electro-optic crystal coupled to a temperature controlled substrate having an associated temperature, the method comprising:

maintaining the temperature controlled substrate, the gain chip and the optical modulator between a first temperature and a second temperature between which the optical modulator has a predefined performance characteristic;

varying a bias voltage applied to the electro-optic crystal from a first voltage to a second voltage;

measuring an operating current supplied to the gain chip as the bias voltage applied to the electro-optic crystal varies from the first voltage to the second voltage;

determining an optimum bias voltage between the first voltage and the second voltage that corresponds to a minimum operating current; and

maintaining the bias voltage applied to the electro-optic crystal at the optimum bias voltage.

18. (Withdrawn): The method as defined in claim 17, wherein determining an optimum bias voltage comprises determining operating current as a function of bias voltage.

19. (Withdrawn): The method as defined in claim 18, wherein determining the optimum bias voltage comprises taking a derivative of the operating current as a function of bias voltage.

20. (Withdrawn): The method as defined in claim 18, wherein determining the optimum bias voltage comprises taking first and second derivatives of the operating current as a function of bias voltage.

21. (Withdrawn): The method as defined in claim 17, further comprising:

measuring the operating current and comparing it to the minimum operating current; and

if a difference between the operating current and the minimum operating current becomes significant, (a) varying the bias voltage applied to the electro-optic crystal from the first voltage to a second voltage, (b) measuring the operating current supplied to the gain chip as the bias voltage applied to the electro-optic crystal varies from the first voltage to the second voltage, (c) determining a second optimum bias voltage that corresponds to a second minimum operating current, and (d) maintaining the bias voltage applied to the electro-optic crystal at the second optimum bias voltage.

22. (Original): A method of manufacturing an external cavity optical transmitter, the method comprising:

selecting an optical modulator having an optimal operating temperature range defined by a first temperature and a second temperature;

placing a gain chip, a grating and a mirror on a substrate that will be maintained at a temperature between the first temperature and the second temperature;

placing a lens mounted to a bipod flexture onto the substrate in proximity to the gain chip;

varying the temperature of the substrate between the first temperature and the second temperature to determine a temperature corresponding to a minimum current provided to the gain chip; and

placing the optical modulator on the substrate.

23. (Original): The method as defined in claim 22, wherein the optimal operating temperature range is defined by chirp performance of the optical modulator.

24. (Original): The method as defined in claim 22, further comprising tuning a gain chip lasing wavelength by placing the lens in an optimized position.

25. (Original): The method as defined in claim 22, further comprising placing the substrate on a temperature controlled platform.

26. (Original): The method as defined in claim 22, further comprising hermetically packaging the optical transmitter.